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Bureau of Entomology and Plant Quarantine

EQUIPMENT FOR DISPERSING INSECTICIDES FROM AIRCRAFT[1/]

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Equipment for dispersing insecticides from aircraft has been made through the use of an auxiliary fuel tank, which is suspended from a bomb shackle attached to the underside of the fuselage. This installation, which is used on a PT-17 (N2S-3) airplane, leaves the front cockpit intact for normal use. The tank can be quickly attached or removed, and equipment for applying different formulations of liquids and dusts can be interchanged on the same plane with a minimum of time and effort.

Bomb-Shackle Assembly

Supports and sway braces (fig. 1) were designed for attaching the bomb-shackle assembly and tank to the plane. The bomb shackle, which is a standard Army Air Forces item, is designated as: Shackle assy. Bomb 11-a M-type B-10, spec. 24832, item 6400-694600, max. load 1600 pounds. The tank is also a standard Army Air Forces item and is designated as: Class 03-L, stock No. 5600-805000 tank, aux., fuel jettison, steel, 75 gallon.

The following specifications for materials used in constructing the truss to attach the bomb-shackle assembly were worked out by E. H. Hagenmueller. The numbers refer to numbered parts shown in figures 1 and 2. S. A. E. 4130 steel was used. The dimensions given are in inches. Subsequent regulations of the Civil Aeronautics Authority have required strengthening the diagonal members in the bottom forward bay of the fuselage with 1 1/8- by 0.035-inch aircraft tubing.

No.		No.	
1	Bomb shackle		Steel tubing:
	Steel tubing:	6	3/8 x .065
2	1 1/8 x .058	7	7/8 x .058
3	1 1/4 x .058	8	5/8 x .035
4	Sheet steel, .095	9	7/8 x .058
5	Streamline tubing, .049	10	3/4 x .049

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No.	Steel tubing:
11	5/8 x .035
12	3/4 x .049
13	5/8 x .035
14	1/2 x .035
15	1/2 x .035
16	5/8 x .065
17	1 1/4 x .058
18	3/8 x .065
19	3/4 x .058
	Sheet metal:
20	.095
21	.049

Equipment for Dispersing Solutions

The equipment for dispersing insecticide solutions is similar to that described by Husman et al. (1) except for the location of the supply tank. It has the conventional wind-driven 5/8-inch gear pump with 5/8-inch fitting leading from the supply tank through the pump to a cut-off valve in the cockpit, where the flow to the booms is controlled. In March 1946 equipment of the type shown in figure 3 was first installed by an insecticide company of Orlando, Fla.

In the installation herein reported, nozzles are attached to 1/4-inch nipples spaced along the trailing edge of under-wing spray booms made from 5/8-inch tubing. The delivery rate and droplet size can be controlled by varying the number of nozzles and the size of the orifice. The rates obtained with fuel oil when two nozzles were used under each wing tip are shown in table 1.

Table 1.--Effect of varying the size of the nozzle orifice on droplet size and delivery rate

Diameter of orifice	Pressure	Rate of delivery	Diameter of droplets	
			Average	Mass median
Inch	Pounds per square inch	Gallons per minute	Microns	Microns
0.031	90	3/4	45	122
.040	80	1 1/4	54	126
.062	65	3	121	178

Equipment for Dispersing Suspensions

The equipment used for dispersing suspensions includes a centrifugal pump with a wind-driven propeller. This pump is designed to give high-volume output at low pressures, and is not self-priming. The delivery rate is 25 gallons per minute at 3,000 r.p.m. with a 25-foot head. The pump is mounted on a special bracket (fig. 4) at the front of the tank, and the intake is on a level with an outlet made by welding a 1-inch pipe in the bottom of the tank. The output from the pump is carried through 1-inch (o.d.) aircraft tubing, curved to fit the tank, to a three-way air-

craft valve mounted on the side of the tank (fig. 4). This valve is controlled from the cockpit of the plane. In the forward (closed circuit) position the material is returned to the tank; this action provides the necessary agitation for materials in suspension. By changing the position of the valve control, the flow is directed to the wing spray booms. The fittings from the valve to the spray booms are 1-inch (o.d.) aircraft tubing, which prevents restriction of the flow from the pump. A neater, more streamlined installation is obtainable by passing the line from the valve through the rear portion of the tank to the spray boom on the opposite side.

Although this equipment was designed primarily for suspensions, it can also be used to disperse solutions when pressures above 20 pounds and small droplet sizes are not required. If higher pressures are desired, a gear pump could be substituted for the centrifugal pump on the tank bracket and the pump mounting on the side of the plane eliminated. In general spray operations, where both suspensions and solutions are to be employed, a high-pressure, low-delivery centrifugal pump would probably give the necessary breakup of material and be more desirable.

The delivery rates of water suspensions obtained with various numbers and sizes of nozzles were as follows:

Number of nozzles	Diameter of orifice	Rate of delivery
	Inch	Gallons per minute
12	0.062	5
8	.093	6
6	.125	7
5	.156	9
6	.187	14

Dust Hopper

A dust hopper was made by cutting away the bottom two-thirds of a tank and making a new flat bottom with sloped sides from 0.035-inch sheet steel. Obstructing bulkheads were removed, except the rear one, which was completely sealed to block off the rear portion of the tank. Chrome-molybdenum-steel tubing, 1/2-inch square, was welded around the cut edge of the upper portion of the tank as a frame and reinforcement. The new portion of the hopper was attached to this frame with 1/4-inch button-head steel bolts.

A gate for releasing the dust was made by cutting 14 crosswise slots, 1 by 4 3/4 inches, in the new tank bottom. Matching slots were cut in a sliding door, which was made of 0.035-inch sheet aluminum. This door was fitted into a channel that runs the length of the hopper, and can be opened or closed by means of a lever in the cockpit. An agitator 53 inches long, with four 1/16-inch wire blades set to form a circle 4 1/2 inches in diameter, was mounted above the gate by a bearing at the front and rear ends.

The agitator is turned by a wind-driven laminated four-blade wooden propeller mounted on the front of the hopper. The power is transmitted to the agitator through a 60-to-1 gear-reducing box, and the shaft from the gear box is attached to the agitator shaft by a flexible universal joint. A brake on the propeller is controlled from the cockpit. The mounting for this assembly was made of 5/8-inch (o.d.) steel tubing welded to the front of the tank (fig. 5).

The hopper has a capacity of 250 to 400 pounds, depending on the bulkiness of the dust. The dust can be released at rates ranging from 100 to 200 pounds per minute by adjusting the sliding gate. Further modifications will be necessary in the gate control to permit accurate changes in delivery rates during flight. Ordinarily the hopper is not completely emptied in one operation, as the discharge tends to become irregular when the load is reduced to the last 50 pounds or less.

Literature Cited

(1) Husman, C. N., Longcoy, O. M., and Hensley, H. S.
1947. Equipment for the dispersal of DDT insecticides by means of aircraft: U. S. Bur. Ent. and Plant Quar. ET 228, 17 pp. (Processed.)

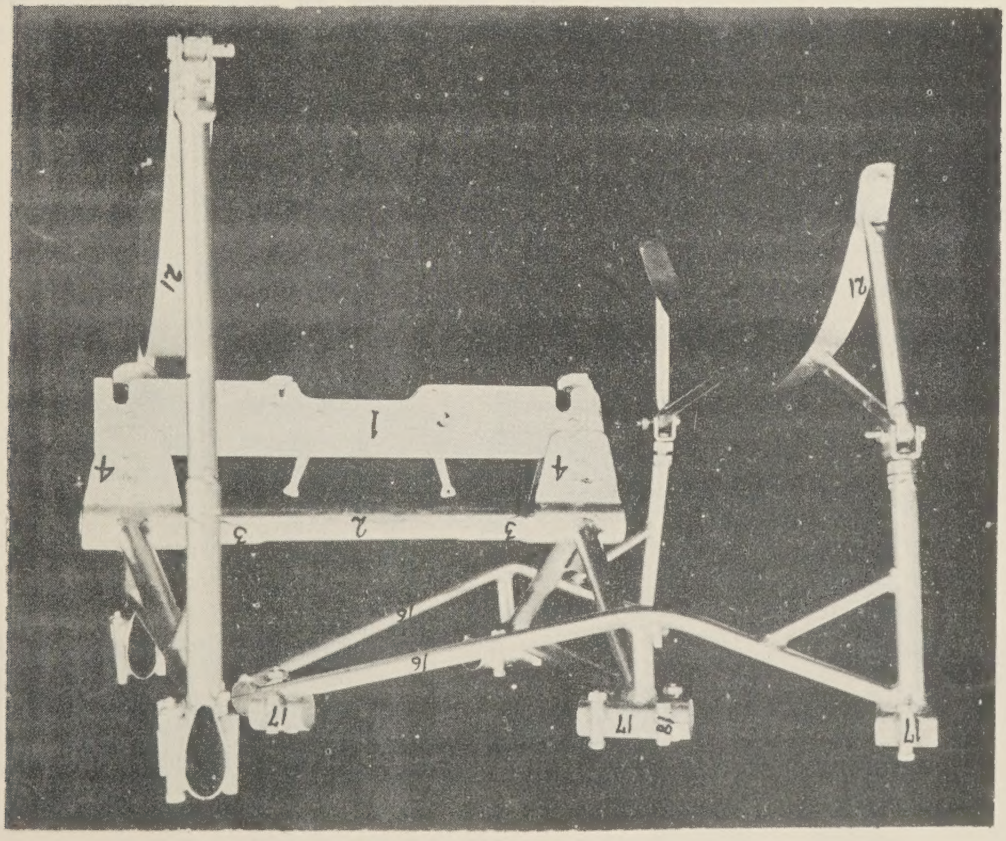

Figure 1.--Side view of supports and sway braces used for attaching bomb-shackle assembly to plane. (See text for explanation of figures.)

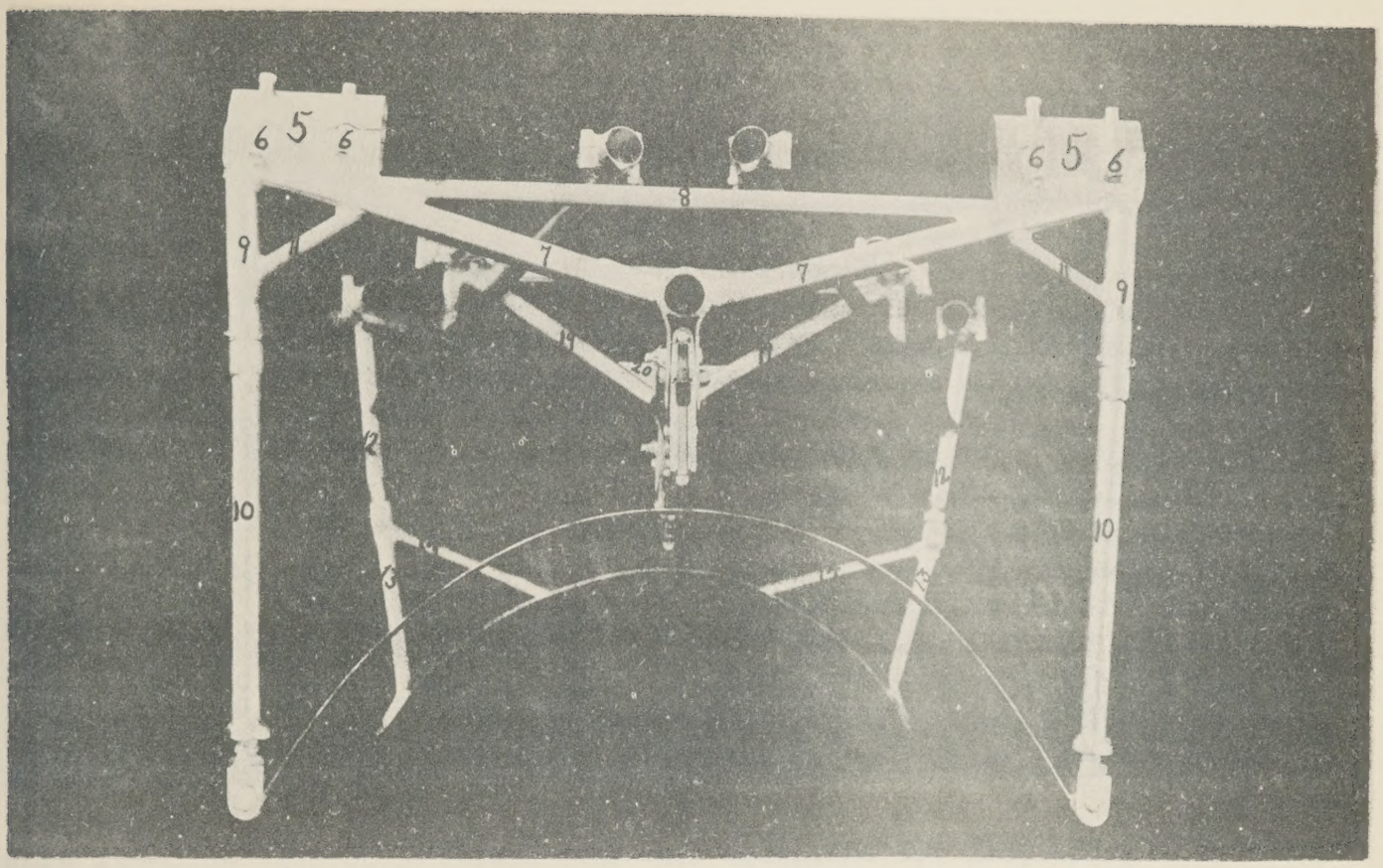

Figure 2.--Rear view of supports and sway braces used for attaching bomb-shackle assembly to plane. (See text for explanation of figures.)

Figure 3.--View of PT-17 (N2S-3) with spray equipment.

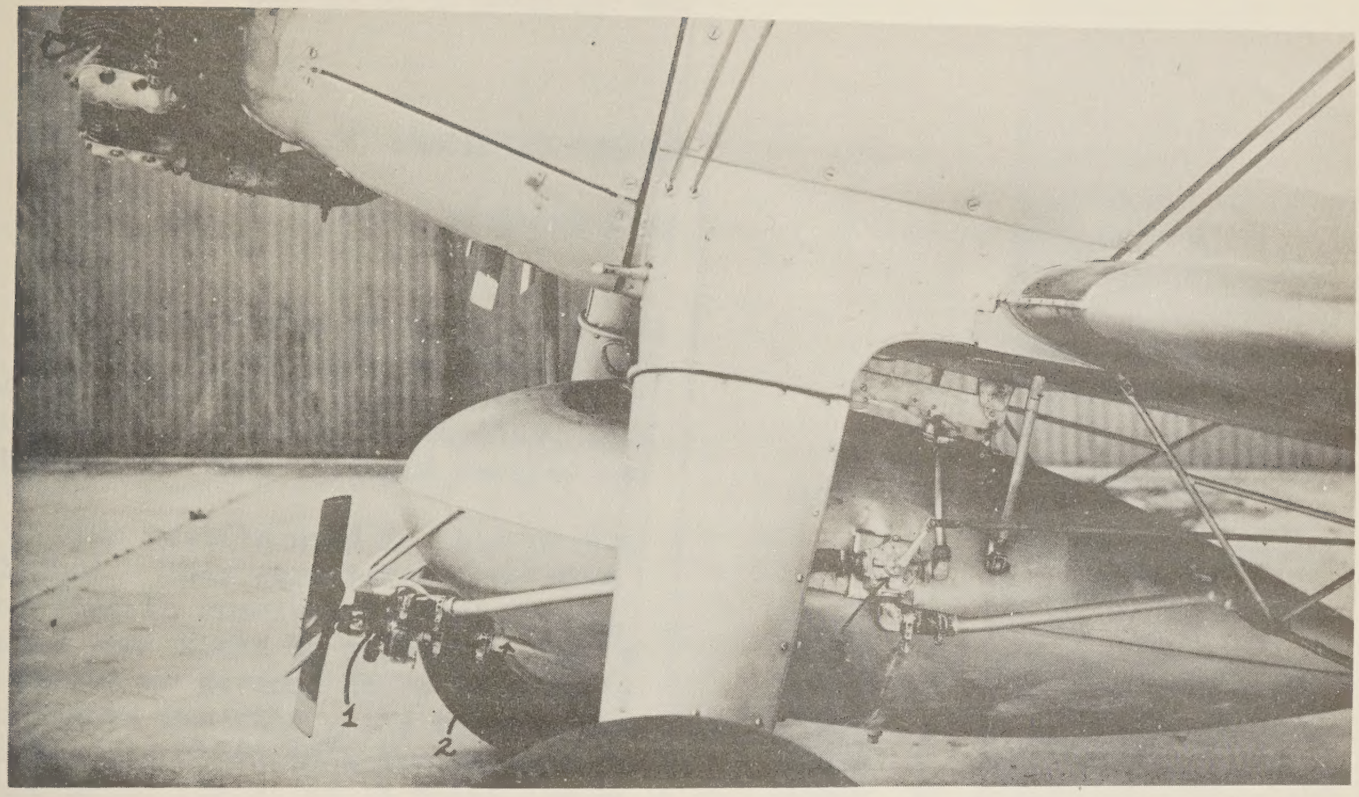

Figure 4.--Side view of jettison tank and equipment for dispersing suspensions, showing positions of pump (1), outlet (2), and control valve (3).

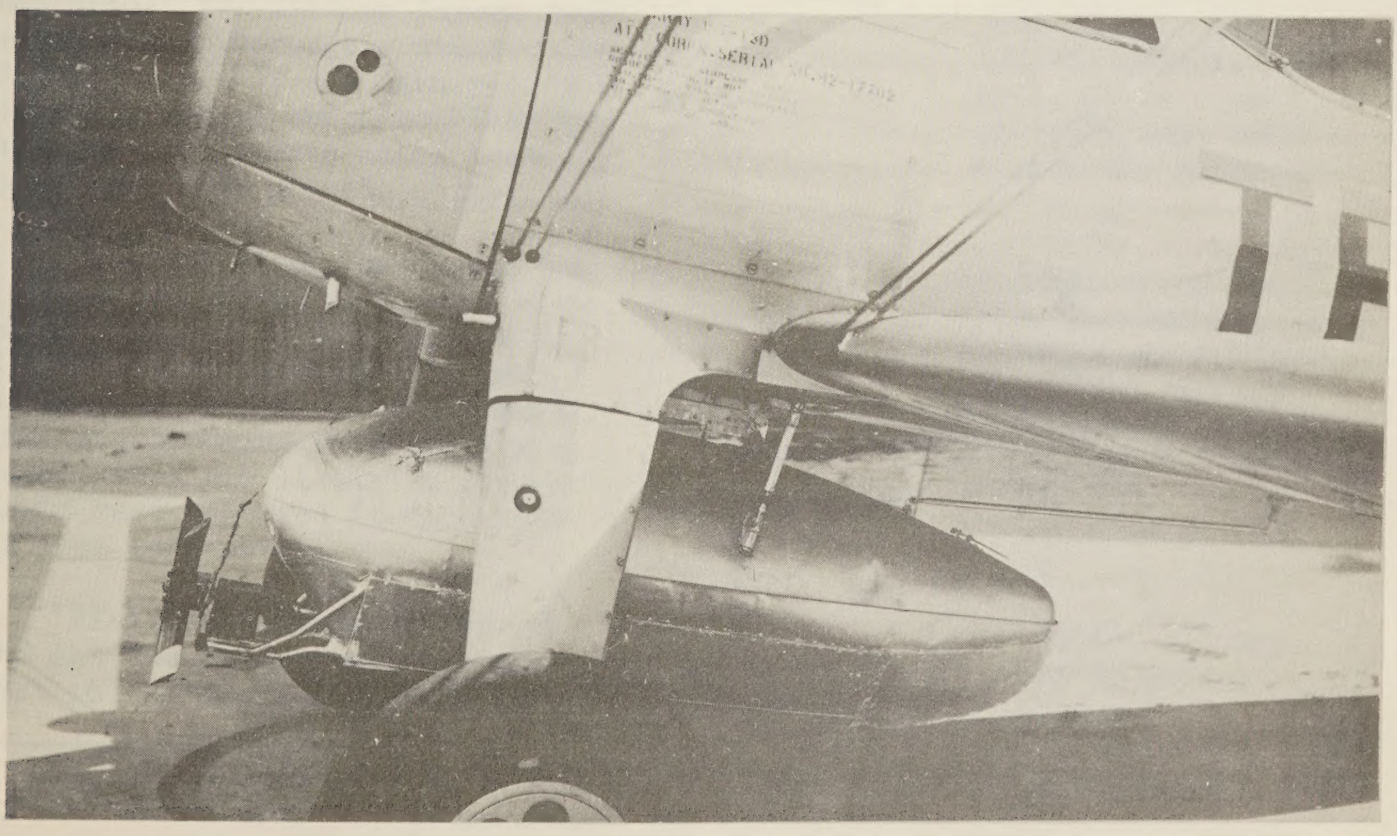

Figure 5.--Side view of duster, showing propeller, gear box, and mount; also the gate control arm near the rear end of the tank.